

BULLETIN OF THE RESEARCH COUNCIL OF ISRAEL

Section B ZOOLOGY

Bull. Res. Council of Israel. B. Zoology

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LETTERS TO THE EDITOR

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A. Shulov and P. Amitai
- 42 Nine new fishes from the Mediterranean coast of Israel *M. Dor*



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ON THE DOMINANCE OF "RECESSIVE" LETHALS

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ABSTRACT

A method of estimating the dominant effect of "recessive" lethal mutations in *Drosophila* is proposed. In this method male and female flies heterozygous for the tested chromosome and a "marked" chromosome are employed as parents. Their offspring are raised in moderately populated cultures. The absolute number of flies bearing the parental genotype which emerge in these cultures serves as an estimate of the viability effects of the tested chromosome from the onset of copulatory activity in the parental cultures to the emergence of the filial heterozygotes.

The method was tested in two experiments, each employing a series of lethal and of non-lethal second chromosomes extracted from a wild population of *D. melanogaster*. In each experiment the average number of heterozygotes for lethal chromosomes was significantly lower than the average number of heterozygotes for non-lethals.

The CyL-Pm technique proposed by Wallace (1956) for the estimation of dominance effects is contrasted with the technique employed in the present study. In order to eliminate both the "replacement" and the "facilitation" effect, a combination of the two methods is suggested.

INTRODUCTION

It is a well known fact that natural populations contain a great deal of concealed genetic variability. Dobzhansky and his colleagues have shown repeatedly that many chromosomes extracted from natural populations carry recessive detrimental mutations. A zygote receiving a double dose of such a chromosome will be severely reduced in viability or doomed to early death (lethal). Similar detrimental mutations are produced by ionizing radiations.

Several lines of investigation indicate that even a single dose of a so-called recessive lethal may produce a measurable reduction in the viability of the heterozygous carrier (Wright, Dobzhansky and Hovanitz 1942; Berg 1942a, 1942b; Muller and Campbell 1950; Stern, Carson, Kinst, Novitski and Uphoff 1952; Cordeiro 1952; Prout 1952; Falk 1955). As Muller (1950) pointed out, the heterozygotes for such mutations far outnumber the homozygotes in natural populations. Hence a very slight expression of such a detrimental factor in a single dose may constitute a more serious threat to the population as a whole than the drastic effect experienced by

* This work is part of the junior author's Ph. D. thesis carried out under the guidance of the senior author. The main part of the thesis will be published elsewhere by the junior author.

the homozygote. Consequently, it is of great importance to estimate the extent of the damage caused by viability mutations in the heterozygote.

The conventional method for estimating viability is based on a cross between males and females heterozygous for the test chromosome and a marked "balancer chromosome" which carries a recessive lethal. Among the offspring of each cross, the ratio of the homozygous carriers of the test chromosome to the heterozygotes possessing the test chromosome and the "balancer chromosome" is determined. This ratio is expected to be close to 1:2 if the test chromosome is free of detrimental mutations. (Depending on the viability effect of the balancer chromosome employed in any particular experiment, a small correction of the expected 1:2 ratio may be required). If the test chromosome is deleterious, a ratio lower than 1:2 is obtained; if it is lethal, no homozygous flies will emerge. This method, referred to as the CyL method by Wallace (1956), fails to give any information on the viability of carriers of the test chromosome in a single dose. It postulates, in fact, that the viability of the heterozygotes in each culture is alike, irrespective of the differences in gene content between the various test chromosomes. Furthermore, when the viability mutation is not fully recessive (i.e. has some degree of dominance), the calculated ratio is a biased estimate of the viability of the homozygote, usually in the direction of normality. Let us assume that a subvital mutation enables only 50% of its carriers in double dose to reach maturity. If it is fully recessive the ratio of the homozygotes to the heterozygotes for the tested chromosome and the marker chromosome will be 1:4 instead of 1:2. But if the mutation is completely dominant the ratio will not diverge from the control ratio, since both classes of progeny are equally reduced, as compared with the numbers in the control. If the mutation is only partially dominant an intermediate situation will arise.

These limitations of the CyL method should be overcome if viability estimates are based on the absolute numbers of individuals in each class emerging in the test cultures. The effects of competition between the two classes and of "replacement" (Stern *et al.* 1952) should be reduced or eliminated if excess of food and space is provided to the progeny of each cross.

The experiment reported here was designed in order to reconfirm the existence of dominance effects of recessive mutations and in order to establish a viability estimate free of some of the limitations of the CyL method.

MATERIAL AND METHODS

The experiment was performed on a series of second chromosomes of *Drosophila melanogaster*. These chromosomes had been extracted from a wild population at Sde Boker (Negev of Israel) and classified for viability effects in the homozygote according to the CyL method, by Goldschmidt, Lederman-Klein and Weiss (unpublished). They were kept balanced over the CyL chromosome. For our purpose the stocks were divided into two groups: those carrying lethals and those free of lethals.

(The latter group contained a single chromosome of the "semi-lethal" type, i.e. with a viability below 50% as estimated by the CyL method). In the first series of experiments flies from each stock were raised in vials. CyL progeny were collected on the first and second day of emergence, virgin males and females from each stock being kept separately. After these two days, 3 females and 3 males from the same stock were mated in a vial with a slanted food surface. They were allowed a 24 hours' period for egg laying. They were then transferred to fresh vials for another 24 hours and were finally discarded. The food from the vials with the eggs laid on its surface was transferred to half-pint culture bottles where the eggs developed. The adult flies emerging were classified and counted. This transfer procedure was adopted in order to avoid overcrowding in the bottles.

Three crosses were prepared for each stock and from each cross the egg yield of two days was secured—thus resulting in six bottles for each stock.

In the second series of experiments the procedure was essentially similar to that described for the first experiment, except for some modifications: 1. The food was introduced into the vials in the form of cubes put on a piece of cardboard. In this manner it was much easier to transfer the food from the laying-vials to the culture bottles. 2. The parents of each cross were transferred to a third vial on the third day after mating. The eggs of the first day were discarded, and only those of the second and third day, respectively, were transferred to culture bottles. This procedure seemed indicated, since the variability in the egg yield of the first day is largely due to differences in the onset of copulatory activity. The fecundity of the flies was much improved by oviposition on the food cubes.

RESULTS

In the first series 27 stocks were tested, 11 carrying lethals and 16 lethal free. In the second series 47 stocks were tested, of which 25 carried lethals while 22 were free of lethals. In the course of the experiment it turned out that the change in crowding conditions necessitated no reclassification of chromosomes as compared with their assignment to the lethal or non-lethal class according to the CyL method.

Our main interest was in the effect of the lethal mutations in the heterozygous condition. Only the numbers of the CyL flies were of importance; these are summarized in Table I.

TABLE I
Average number of CyL flies per bottle

	Series No. 1			Series No. 2		
	1st day	2nd day	Total	2nd day	3rd day	Total
Lethal stocks	24.7	29.1	27.0	45.9	67.0	56.3
Non-lethal stocks	38.9	35.9	37.4	56.4	76.1	66.3

It is obvious that the average number of the heterozygotes for the non-lethals, in both experiments, and from both the first and second days of egg-laying, was higher than that of heterozygotes for lethals. Table II presents the results of the analysis of variance.

TABLE II
Analysis of variance of the results

Source of variance	Series 1				Series 2			
	df	Mean Square	F	P	df	Mean Square	F	P
Lethals vs. non-lethals	1	3678.21	19.6	<0.001	1	6802.19	16.6	<0.001
Stocks within the above	25	415.01	2.2	<0.001	45	2173.34	5.3	<0.001
Crosses within stocks	51	543.88	2.9	<0.001	93	1190.70	2.9	<0.001
Between days of egg-laying	64	188.03			139	409.30		
Total	141				272			

The difference between the two groups of stocks is highly significant. Since the viability effects of some stocks should be fully recessive, while that of others may be more or less dominant, it is not surprising that the variance between stocks within each group is also significant. Figure 1 indicates that certain lethal stocks showed excellent combining ability with the CyL chromosome and that a single lethal appeared even superior in this combination to the heterozygotes for all non-lethal chromosomes included in the experiment.

DISCUSSION

Stern *et al.* (1952) showed that in over-crowded cultures, with strong competition for food, the absolute numbers of two genotypes developing side by side are not independent. When an excess of eggs is laid, the regular lethality of one genotype gives rise to a numerical increase of the other class. It was the aim of the present experiment to forestall this "replacement" effect. Table I indicates that this object was achieved. If competition between the genotypes in the non-lethal cultures had been at work,

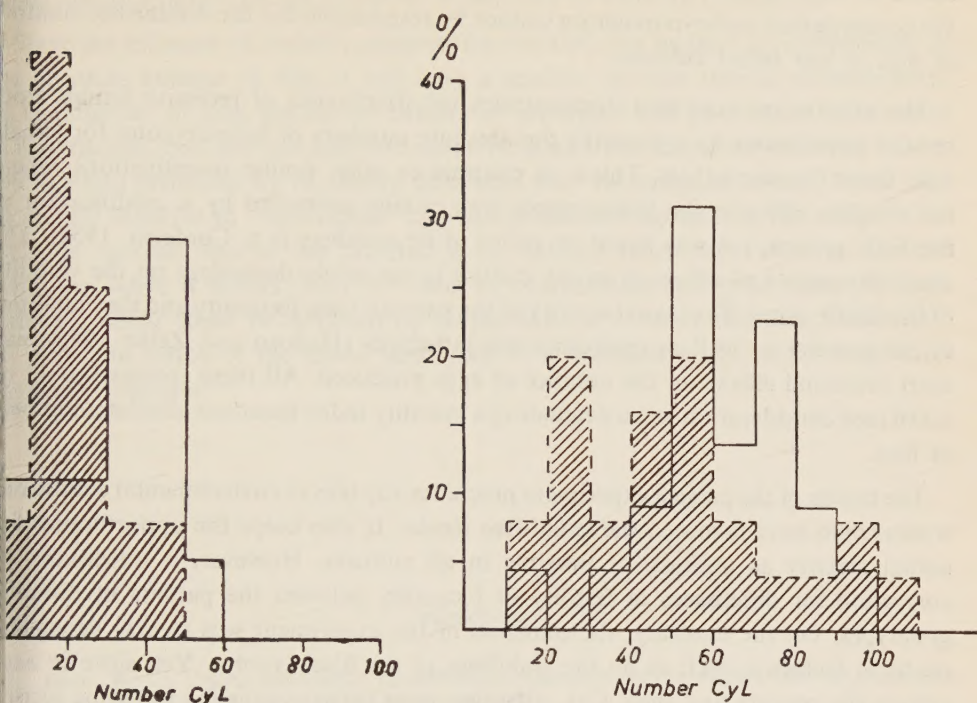


Figure 1

average number of CyL flies per culture bottle in lethal (cross-hatched) and non-lethal (white) stocks. Abscissa—average number of CyL flies per culture bottle. Ordinate—percentage of stocks. Left: first experiment. Right: second experiment.

would have led to an overall decrease of the CyL class in comparison with the average number of this type in the lethal stocks. The difference observed in reality was in the opposite direction. It appears justified to attribute this effect to a reduction of the viabilities of the CyL flies carrying lethal chromosomes.

Lewontin's (1955) extensive experiment on viability effects at different larval densities in vials has demonstrated an adverse influence of extreme under-population of the culture medium. Viability was optimal at moderate larval densities (2-4 larvae per vial). Although larval densities in vials and in bottles are not strictly comparable, it is clear that the population densities in our bottles were "intermediate" by Lewontin's standards and not equivalent to his lowest density (1 larva per vial). A few bottles (never two of the same chromosome) yielding five flies or less were not included in our calculations. Lewontin's Tables III and IV contain data on the viabilities of certain strains at low densities in pure culture and on their viabilities in different vials where the density is doubled by the addition of another genotype. Although individual strains may react with a rise in viability, the *average* viability of all strains

tested is reduced, even at the lowest densities, by the introduction of competitors. We conclude that under-population cannot be responsible for the diminished number of flies in our lethal cultures.

The experiment described demonstrates the dominance of recessive lethals from natural populations by comparing the absolute numbers of heterozygotes for lethals with those for non-lethals. This is in contrast to other similar investigations, where the viability effect in the heterozygote was usually estimated by a modification of the CyL system, i.e. was based on ratios of fly numbers (e.g. Cordeiro 1952). The absolute number of offspring in any culture is not solely dependent on the viability of the filial zygotes. The sexual activity of the parents, their fecundity and the viability of the gametes as well as environmental influences (Hadorn and Zeller 1943) may exert profound effects on the number of eggs produced. All these factors should be taken into consideration when evaluating a viability index based on absolute numbers of flies.

The design of the present experiment precludes any bias in environmental conditions which could have favoured the lethal-free stocks. It also keeps the opportunities for sexual activity as uniform as possible in all cultures. However, it introduces no correction for differences in fertility or fecundity between the parents of different genotypes. On the contrary, the outcome of the experiment was clearly dependent on these factors as well as on the viabilities of the filial zygotes. Yet, since in each culture the parents and their CyL offspring were heterozygous for the same second chromosome, all components of fitness which may have contributed to the results can be ascribed to dominance effects of this chromosome. The result is therefore an estimate of the viability effect exerted by the test-chromosome from the onset of mating in the parent generation to the emergence of the filial flies. In this regard the present experiment differs from those of previous authors in whose cultures fertility and fecundity effects of the parental generation were deliberately minimized through over-crowding (Stern *et al.* 1952, Cordeiro 1952). Nor can the results be compared with those of Falk (1955), who measured a single component of viability, namely hatchability.

The average dominant effect of lethal chromosomes appears more pronounced in the present experiment than estimated by previous authors. We are inclined to attribute this difference to the design of our experiment, which eliminates replacement and measures the components of fitness with the exception of longevity during the complete life cycle.

An elegant method of estimating the viabilities of homozygotes as well as of heterozygotes with reference to a standard test genotype has been described by Wallace (1956) as his CyL-Pm technique. Bonnier (1957) finds that the results obtained by this method have a smaller variance than those of the CyL technique, but are highly correlated with them. He concludes that for routine estimates of homozygote

abilities it is usually sufficient to use the simpler CyL method. However, this method yields no information on the degree of dominance of viability mutations.

Since the estimate of viability obtained by the CyL-Pm method is independent of the absolute number of flies, it will have a smaller variance than an estimate based on the number of flies, but as the number of genotypes and phenotypes is increased in this method, competition and interaction between them may complicate the results. The method proposed by us clearly eliminates the "replacement" effect, but it may be unduly sensitive to "facilitation" in under-populated media. The advantage of the CyL-Pm method lies in the calculation of viability ratios referred to a standard genotype, while it suffers from the effect of competition. It appears that the most unbiased result could be achieved by a combination of both methods. This would be based on ratios of the tested genotypes to a standard genotype in moderately populated cultures.

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ON A COLLECTION OF POLYCHAETES FROM THE MEDITERRANEAN COAST OF ISRAEL

N. TEBBLE

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INTRODUCTION

This paper deals primarily with a collection made off the Mediterranean coast of Israel in 1947-50 by Dr. A. Yashouv (Wirszubski). In addition collections made by Prof. G. Haas in 1933-35 and 1948-49 have been examined; of these the 1933-35 collection was originally identified by C. C. A. Monro of the B. M. (N. H.) and a few of the species were reported by him in 1937. However, much of his material was not reported and was deposited in the Hebrew University of Jerusalem and at the time of writing was not available for study, but the remaining material in the B. M. (N. H.) has been re-examined and details on it are included here.

In the Systematic Section remarks on species have been cut to a minimum since the majority of them can be identified directly from Fauvel 1923 or 1927. Altogether 48 species of Polychaetes are here reported from Israel, of which one is new to science.

My thanks are extended to Dr. A. Yashouv, Prof. G. Haas and Prof. K. Reich for having provided this material for study, part of which is now deposited in The Hebrew University of Jerusalem and the remainder in the B. M. (N. H.).

STATION LIST AND CHART (Figure 1)

Details of Station numbers (Yashouv Coll.).

Station number	Locality	Depth (Metres)	Gear	Date
507	Atlit	16	Dredge	18.VI.47
509	Atlit	35	Dredge	18.VI.47
519	Kfar Vitkin	90	Grab	18.VI.47
520	Kfar Vitkin	90	Dredge	18.VI.47
522	Tel Aviv	90	Grab	19.VI.47
524	Tel Aviv	50	Dredge	19.VI.47
538	Gaza	27	Dredge	21.VI.47
539	Gaza	54	Grab	21.VI.47
540-39	Gaza	54	Dredge	21.VI.47
547	Rafah	54	Grab	21.VI.47
552	Nahariya	45	Dredge	23.VII.47
565	Caesarea	135	Grab	24.VII.47
568	Natanya	54	Dredge	26.VII.47

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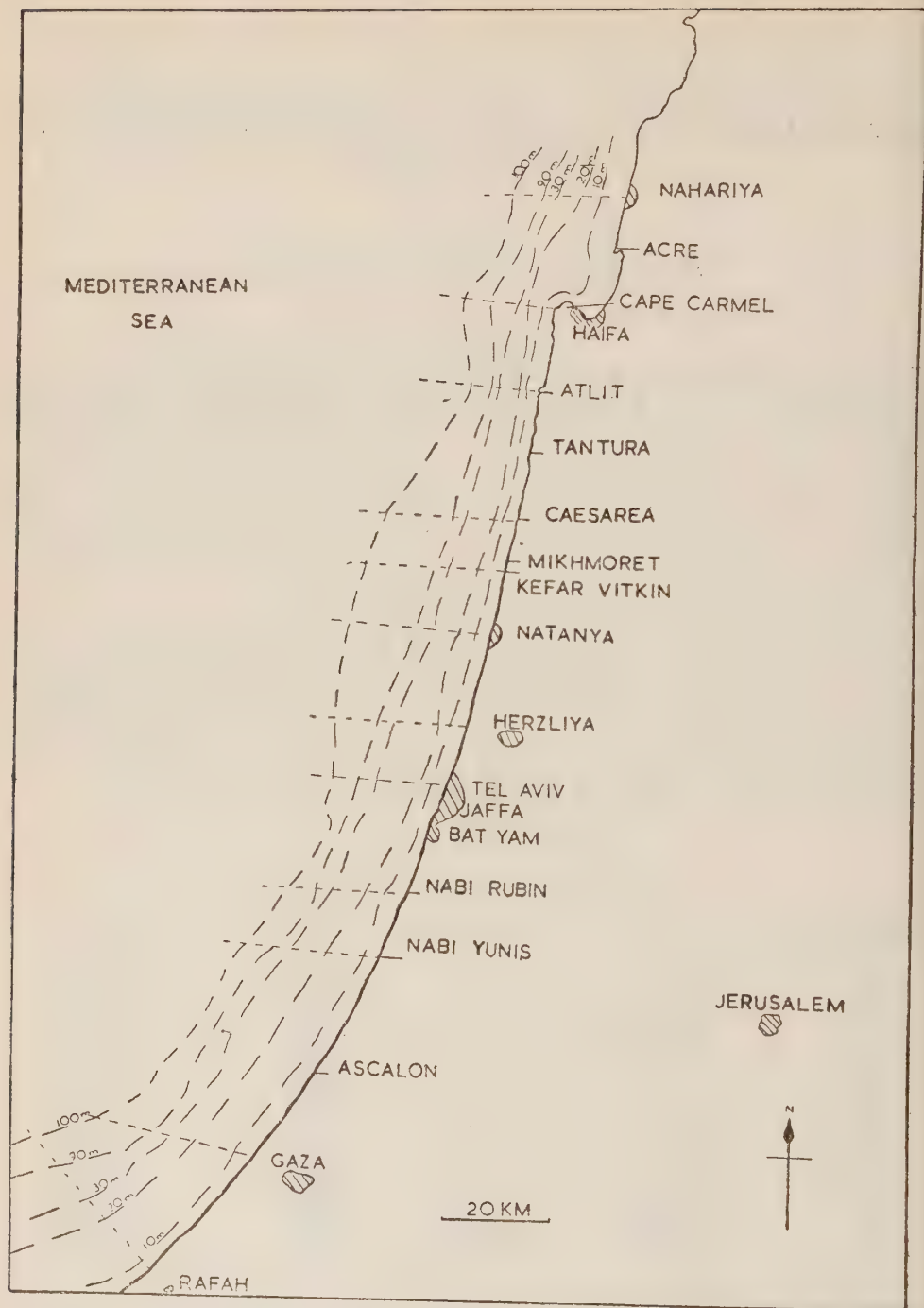


Figure 1

Chart of the sea off the Israel coast showing the lines along which the collections were made

Station number	Locality	Depth (metres)	Gear	Date
569	Natanya	90	Grab	26. VII. 47
570	Natanya	135	Grab	26. VII. 47
573	Nabi Rubin	54	Grab	27. VII. 47
574	Nabi Rubin	90	Grab	27. VII. 47
576	Nabi Rubin	145	Grab	27. VII. 47
581	Ashkelon	90	Grab	27. VII. 47
614	Atlit	90	Grab	27. VIII. 47
618	Kfar Vitkin	90	Grab	28. VIII. 47
620	Tel Aviv	20	Grab	29. VIII. 47
625	Nabi Yunis	54	Grab	30. VIII. 47
627	Nabi Yunis	135	Grab	30. VIII. 47
629	Gaza	45	Grab	30. VIII. 47
630	Gaza	90	Grab	30. VIII. 47
632	Rafah	18	Grab	31. VIII. 47
633	Rafah	45	Grab	31. VIII. 47
634	Rafah	90	Grab	31. VIII. 47
636	Nahariya	20	Dredge	18. IX. 47
637	Nahariya	55	Grab	18. IX. 47
638	Nahariya	70	Grab	18. IX. 47
643	Caesarea	135	Grab	26. IX. 47
644	Herzliya	20	Grab	26. IX. 47
647	Herzliya	137	Grab	26. IX. 47
648	Nabi Rubin	18	Grab	30. IX. 47
649	Nabi Rubin	54	Grab	30. IX. 47
650	Nabi Rubin	90	Grab	30. IX. 47
656	Gaza	54	Grab	1. X. 47
657	Gaza	90	Grab	1. X. 47
661	Nahariya	54	Grab	11. XI. 47
662	Atlit	18	Grab	12. XI. 47
663	Atlit	55	Grab	12. XI. 47
664	Atlit	87	Grab	12. XI. 47
665	Atlit	135	Grab	12. XI. 47
667	Kfar Vitkin	54	Grab	13. XI. 47
671	Tel Aviv	53	Grab	14. XI. 47
672	Tel Aviv	90	Grab	14. XI. 47
673	Tel Aviv	135	Grab	14. XI. 47
674	Nabi Yunis	135	Grab	14. XI. 47
678	Gaza	90	Dredge	15. XI. 47
682	Atlit	36	Dredge	2. XIII. 48
686	Caesarea	18	Dredge	2. XIII. 48
692	Tel Aviv	72	Dredge	4. XII. 48
694	Atlit	54	Dredge	9. IX. 48
695	Atlit	90	Dredge	9. IX. 48
700	Caesarea	18	Dredge	10. IX. 48
703	Natanya	90	Dredge	11. IX. 48
709	Atlit	18	Not known	22. IX. 48
716	Nabi Rubin	54	Not known	1. XII. 48
717	Nabi Rubin	81	Not known	1. XII. 48
719	Tel Aviv	18	Not known	1. XII. 48
724	Atlit	54	Not known	23. II. 49
725	Cape Carmel	Not known	Not known	23. II. 49
726	Caesarea	135	Not known	1. III. 49
727	Caesarea	90	Not known	1. III. 49
728	Caesarea	54	Not known	1. III. 49

Station number	Locality	Depth (metres)	Gear	Date
733	Atlit	180	Not known	21. III. 49
735	Caesarea	54	Not known	24. III. 49
738	Tel Aviv	90	Not known	23. V. 49
739	Tel Aviv	40	Not known	23. V. 49
741	Nabi Rubin	56	Not known	24. V. 49
743	Nabi Rubin	138	Not known	24. V. 49
744	Tel Aviv	18	Not known	24. V. 49
746	Herzliya	55	Not known	25. V. 49
749	Atlit	135	Not known	26. V. 49
751	Caesarea	88	Not known	26. V. 49
757	Atlit	54	Grab	20. VI. 49
766	Herzliya	18	Grab	24. VI. 49
769	Tel Aviv	137	Grab	24. VI. 49
771	Nabi Yunis	18	Grab	25. VI. 49
773	Nabi Yunis	90	Grab	25. VI. 49
776	Natanya	54	Grab	26. VI. 49
778	Natanya	137	Grab	26. VI. 49
779	Tel Aviv	90	Grab	26. VI. 49
783	Atlit	90	Grab	15.VIII.49
784	Atlit	135	Grab	15.VIII.49
787	Nabi Yunis	54	Grab	18.VIII.49
792	Natanya	54	Grab	19.VIII.49
794	Natanya	137	Grab	19.VIII.49
795	Nabi Rubin	18	Grab	20.VIII.49
798	Nabi Rubin	90	Grab	20.VIII.49
800	Tel Aviv	137	Grab	20.VIII.49
804	Caesarea	137	Grab	23.VIII.49
805	Caesarea	90	Grab	23.VIII.49
807	Caesarea	18	Grab	23.VIII.49
861	Nabi Rubin	54	Grab	13. II. 50
875	Tel Aviv	90	Grab	15. II. 50

The following stations are those at which Dr. G. Haas collected by hand on the shore; they are all within a depth of about 50 cm.

Stn. No.	Locality	Date
2	Atlit	12.IX.49
3	Atlit	12.IX.49
4	Atlit	12.IX.49
5	Bat Yam	5. X. 48
7	Tantura	13.IX.49
9	Atlit	12.IX.49
10	Tantura	13.IX.49

DISTRIBUTION AND LIST OF SPECIES

Since the opening of the Suez Canal zoogeographical interest in the adjacent areas has centred on the possibility of species migrating through it from the Red Sea to the Mediterranean or vice versa. From the present collection no new records of possible migrants have been found, but confirmation of one of three such records made by Monro (1937) is noted. Thus Monro reported *Dasychone cingulata*, which I have also found, *Syllis exilis* and *Opisthosyllis brunnea*, the identification of which I confirm.

Only two papers have previously been published on the polychaetes of this coast (Monro 1937, Fauvel 1955).* The material making up the five species reported by Monro has been re-examined but Fauvel reported the following seventeen species which have not been found in the present collection:

Eumida sanguinae (Oersted), 1843.

Syllis prolifer Krohn, 1852.

Syllis amica Quatrefages, 1865.

Nereis caudata (Delle Chiaje), 1841.

Nereis rava Ehlers, 1868.

Pseudonereis anomala Gravier, 1900.

Eunice siciliensis Grube, 1840.

Glycera convoluta Keferstein, 1862.

Nainereis laevigata (Grube), 1855.

Dodecaceria concharum Oersted, 1843.

Armadia cirrosa Filippi, 1861.

Amphitrite rubra (Risso), 1826.

Nicolea venustula (Montagu), 1817.

Dasychone lucullana (Delle Chiaje), 1828.

Spirorbis pagenstecheri Quatrefages, 1865.

Mercierella enigmatica Fauvel, 1922.

Josephella marenzelleri Caullery and Mesnil, 1896.

Of these only *Pseudonereis anomala* is a possible migrant from the Red Sea. The total number of species now recorded from the area, therefore, is 65 and this number must be taken to represent an impoverished fauna. The reasons for this are doubtless complex but the absence of a true intertidal zone is probably the most important, for most of the species which have been reported are typical sub-littoral forms, and it is from an intertidal region that one would expect a large number of species.

In the following lists an attempt has been made to indicate the distributional ranges of each species, ecologically off the Israeli coast and geographically throughout the world. The importance of the ecological ranges can only be estimated when more collections have been made—at best they might provide a pointer to an important sub-littoral zonation. The geographical distribution has been prepared from a survey of the literature and material in the B. M. (N. H.), and as far as is possible all records are accurate.

* Since going to press, two further papers (Fauvel 1957, Fauvel 1958) have also been published and should be consulted.

Distribution of species of Polychaetes

Species	ISRAEL				Atlantic Ocean	WORLD				Cosmopolitan
	Shore to 50 cm	Metres from shore				Mediterranean Sea	Red Sea	Indian Ocean		
		16-60	61-90	91-180						
APHRODITIDAE										
<i>Pontogenia chrysocoma</i>		x			x	x		x		
<i>Sigalion mathildae</i>		x			x	x		x		
<i>Leanira yhleni</i>		x	x	x	x	x		x		
<i>Lepidonotus clava</i>	x		x		x	x	x	x		
<i>Lepidasthenia maculata</i>		x			x	x		x		
AMPHINOMIDAE										
<i>Eurythoë complanata</i>	x	x			x	x	x	x		
<i>Hermodice carunculata</i>		x			x	x				
HESTONIDAE										
<i>Castalia punctata?</i>			x		x	x				
SYLLIDAE										
<i>Syllis (Typosyllis) variegata</i>	x	x			x	x	x	x	x	
<i>Syllis (Typosyllis) hyalina</i>		x			x	x		x		
<i>Syllis (Typosyllis) exilis</i>	x					x	x	x		
<i>Syllis (Ehlersia) cornuta</i>		x			x	x		x		
<i>Trypanosyllis zebra</i>		x			x	x	x	x		
<i>Opisthosyllis brunnea</i>	x					x		x		
<i>Sphaerosyllis pirifera</i>		x				x				
NEREIDAE										
<i>Nereis zonata</i>	x				x	x	x	x		
<i>Perinereis cultrifera</i>	x				x	x	x	x		
<i>Platynereis dumerilii</i>	x				x	x	x	x	x	
NEPHTHYDIDAE										
<i>Nephtys hystricus</i>	x	x	x	x	x	x				
<i>Aglaophamus inermis</i>		x		x	x	x	x			
GLYCERIDAE										
<i>Glycera tessellata</i>	x	x	x	x	x	x	x	x	x	
<i>Glycera rouxii</i>		x	x	x	x	x	x	x		
EUNICIDAE										
<i>Eunice torquata</i>		x			x	x				
<i>Diopatra neapolitana</i>		x			x	x	x	x		
<i>Hyalinoecia tubicola</i>			x		x	x	x	x	x	
<i>Lumbrineris impatiens</i>			x	x	x	x	x	x		
<i>Drilonereis filum</i>		x	x		x	x	x	x	x	
ORBINIIDAE										
<i>Orbinia foetida</i>	x				x	x		x		
<i>Scoloplos haasi</i>	x					x				

Distribution of species of Polychaetes

Species	ISRAEL				WORLD				
	Shore to 50 cm	Metres from shore 16-60	61-90	91-180	Atlan- tic Ocean	Mediterranean Sea	Red Sea	Indian Ocean	Cosmo- politan
SPIONIDAE									
<i>Prionospio ehlersi</i>		×	×	×	×	×			
<i>Prionospio steenstrupi</i>		×	×	×	×	×		×	
<i>Prionospio cirrifera</i>					×	×			
MAGELONIDAE									
<i>Magelona papillicornis</i>		×			×	×		×	
DISOMIDAE									
<i>Poecilochaetous serpens</i>			×		×	×			
PARAONIDAE									
<i>Aricidea assimilis</i> sp. nov.		×	×	×		×			
FLABELLIGERIDAE									
<i>Stylarioides eruca</i>		×			×	×	×	×	
OPHELIIDAE									
<i>Polyophthalmus pictus</i>	×	×			×	×	×	×	
CAPITELLIDAE									
<i>Notomastus</i> sp.		×				×			
MALDANIDAE									
<i>Clymene (Praxillella) gracilis</i>		×	×	×	×	×	×		
<i>Clymene (Praxillella) lophoseta</i>		×				×			
<i>Johnstonia clymenoides</i>	×				×	×			
OWENIIDAE									
<i>Owenia fusiformis</i>		×			×	×	×	×	×
STERNASPIDAE									
<i>Sternaspis scutata</i>		×	×	×	×	×	×	×	×
AMPHARETIDAE									
<i>Amphicteis gunneri</i>		×	×	×	×	×		×	
TEREBELLIDAE									
<i>Terebellides stroemi</i>		×	×	×	×	×	×	×	×
SABELLIDAE									
<i>Dasychone cingulata</i>	×					×	×	×	
SERPULIDAE									
<i>Serpula vermicularis</i>		×			×	×	×	×	×
<i>Hydroides norvegica</i>		×			×	×	×	×	

SYSTEMATIC SECTION

APHRODITIDAE

APHRODITINAE

Hermioninae, Fauvel, 1923, p. 32.

Pontogenia Claparède, 1868

Pontogenia chrysocoma (Baird), 1865

Pontogenia chrysocoma, Fauvel, 1923, pp. 38–39, fig. 13, a–f.

Localities: (a) Off Nahariya, Stn. 636 (1) complete 8 mm long.

(b) Off Atlit, Stn. 682 (1) complete 12 mm long.

SIGALIONINAE

Sigalion Audouin and Milne-Edwards, 1829

Sigalion mathildae Audouin and Milne-Edwards, 1832

Sigalion mathildae, Fauvel, 1923, pp. 103–104, fig. 39, a–l.

Localities: (a) Off Herzliya, Stn. 644 (1).

(b) Off Nabi Rubin, Stn. 648 (1); Stn. 795 (1).

All specimens complete, between 8 and 16 mm long.

Leanira Kinberg, 1855

Leanira yhleni Malmgren, 1867

Leanira yhleni, Fauvel, 1923, pp. 117–118.

Localities: (a) Off Kfar Vitkin, Stn. 520 (2); Stn. 618 (1); Stn. 667 (1).

(b) Off Nabi Yunis, Stn. 625 (1).

(c) Off Nabi Rubin, Stn. 649 (1); Stn. 650 (1).

(d) Off Gaza, Stn. 656 (1).

(e) Off Atlit, Stn. 664 (1).

(f) Off Tel Aviv, Stn. 692 (1); Stn. 739 (1).

(g) Off Natanya, Stn. 794 (1).

All these specimens are fragmentary, measuring between 10 and 60 mm long.

POLYNOINAE

Lepidonotus Leach, 1816

Lepidonotus clava (Montagu) 1808

Lepidonotus clava, Fauvel, 1923, pp. 46–48, fig. 16, a–e.

Localities: (a) Shore, Jaffa, summer, 1933 (3), 1 complete, 12 mm long.

(b) Off Nahariya, Stn. 638 (1), complete, 4 mm long.

Lepidasthenia Malmgren, 1865

Lepidasthenia maculata Potts, 1909

Lepidasthenia maculata, Fauvel, 1923, pp. 88–89, fig. 33, p–k.

Locality: Off Natanya, Stn. 568 (1), complete, 49 mm long.

APHINOMIDAE

Eurythoë Kinberg, 1857

Eurythoë complanata (Pallas), 1766

Eurythoë complanata, Fauvel, 1932, pp. 45–46.

Eurythoë complanata, Monro, 1937, p. 82.

Localities: (a) Shore, Atlit, December, 1934 (7); Stn. 2 (2).

(b) Shore, Bat-Yam, Stn. 5 (3).

(c) Shore, Tantura, Stn. 7 (1).

(d) Off Atlit, Stn. 709 (2).

All specimens from the shore are of average size for the species, measuring between 80 and 95 mm long, but the two from Stn. 709, at a depth of 18 metres, are only 8 and 10 mm long.

Hermodice Kinberg, 1857

Hermodice carunculata (Pallas), 1766

Hermodice carunculata, Fauvel, 1923, pp. 130–131, fig. 47, a-k.

Locality: Off Atlit, Stn. 682 (1), complete, 8 mm long: Stn. 694 (2), both complete, 17 and 15 mm long.

HESIONIDAE

Castalia Savigny, 1822

Castalia punctata (O. F. Müller), 1776

Castalia punctata, Fauvel, 1923, pp. 240–241, fig. 89, f-k.

Locality: Off Gaza, Stn. 630 (1).

This specimen is incomplete, measuring 2 to 3 mm in length for the head and even anterior chaetigers, and is in a poor state of preservation.

SYLLIDAE

SYLLINAE

Syllis Savigny, 1818

Subgenus *Typosyllis* Langerhans, 1879

Syllis (*Typosyllis*) *variegata* Grube, 1860

Syllis (*Typosyllis*) *variegata*, Fauvel, 1923, p. 262, fig. 97, h-n.

Localities: (a) Shore, Jaffa, April, 1933 (2), complete, 5–6 mm long, and south of Jaffa 23.IV.33 (1), complete, 5 mm long.

(b) Off Nahariya, Stn. 552 (3), anterior fragments 4 mm long; Stn. 636 (3), anterior fragments 3–4 mm long.

(c) Off Atlit, Stn. 709 (1), complete, 7 mm long.

The species lacks an occipital flap on the posterior border of the prostomium and has an anterior tooth on the pharynx, bidentate articles on compound chaetae, and simple chaetae; dorsal cirri are alternately long and short with about 25 or 40 articles.

Syllis (*Typosyllis*) *hyalina* Grube, 1863

Syllis (*Typosyllis*) *hyalina*, Fauvel, 1923, pp. 262–263, fig. 98, a-b.

Locality: Off Nahariya, Stn. 636 (2), incomplete, 1 and 2.5 mm long.

Syllis (Typosyllis) exilis Gravier, 1900*Syllis exilis*, Fauvel, 1932, p. 77.*Syllis exilis*, Monro, 1937, pp. 82–83.

Locality: Shore, Atlit, 7.IX.35 (2), complete, 5 and 9 mm long.

This species has no simple chaetae. The compound chaetae are of three kinds (1) with characteristic strongly curved, sickle-shaped, unidentate terminal articles in the lower division of middle and posterior feet; (2) with bidentate terminal articles in anterior feet, the article being only slightly curved; and (3) with slightly bidentate terminal articles in the middle and posterior feet, the article being strongly curved but not sickle-shaped. I do not agree with Fauvel (1917) that a swelling on the shaft of the chaetae, near the articulating surface, is characteristic of this species; as Monro (1933) has pointed out, this can also be present in *Syllis krohnii*. One other characteristic which may be of diagnostic importance is the position of the eye-spots; these lie in an arc, concave anteriorly, on the back of the prostomium, and are not set in a trapezium, as is normal in *Syllis*.

Subgenus *Ehlersia* Langerhans, 1879*Syllis (Ehlersia) cornuta* Rathke, 1843*Syllis (Ehlersia) cornuta*, Fauvel, 1923, pp. 367–368, fig. 100, g-i.

Localities: (a) Off Atlit, Stn. 663 (3), 1 complete, 12 mm long; Stn. 757 (1), incomplete, 4 mm long.

(b) Off Caesarea, Stn. 735 (1), incomplete, 3 mm long.

Trypanosyllis Claparède, 1864*Trypanosyllis zebra* Grube, 1840*Trypanosyllis zebra*, Fauvel, 1923, pp. 269–270, fig. 101, a-e.

Locality: Off Atlit, Stn. 709 (1), incomplete, 20 mm long.

Opisthosyllis Langerhans, 1879*Opisthosyllis brunnea* Langerhans, 1879*Opisthosyllis brunnea*, Fauvel, 1930, pp. 15–16, fig. 2, a-k.*Opisthosyllis brunnea*, Monro, 1937, p. 83,

Locality: Shore, Tel Aviv (1), complete, about 10 mm long.

This species is characterised by having a tooth in the posterior part of the pharynx and an occipital flap on the posterior of the prostomium. Tentacles and cirri are articulated; compound chaetae are unidentate, with swollen shafts; simple chaetae appear on far posterior segments.

EXOGENINAE

Sphaerosyllis Claparède, 1868*Sphaerosyllis pirifera* Claparède, 1868*Sphaerosyllis pirifera*, Fauvel, 1923, pp. 301–302, fig. 115, 1-p.

Locality: Off Nahariya, Stn. 636 (6), all complete, 2–4 mm long.

NEREIDAE

Nereis Linnaeus, 1758*Nereis zonata* Malmgren, 1867*Nereis zonata*, Fauvel, 1923, pp. 338-339, fig. 130, g-n.

Locality: Jaffa, 24.IV.33 (2), 1 complete, 14 mm long, the other incomplete, 22 mm long; both atokous.

These specimens were first identified by Monro in 1937 but not reported. With respect to the smaller specimen I confirm his identification, but there is doubt about the larger one, which carries two teeth on Group 1 of the proboscis instead of the normal condition in which teeth may be absent or only one present. In both specimens posterior parapodia have lost the terminal articles on notopodial chaetae, making confirmation of the presence of a large homogomph falciger impossible.

Perinereis Kinberg, 1865*Perinereis cultrifera* (Grube), 1840*Perinereis cultrifera*, Fauvel, 1923, pp. 352-354, fig. 137, a-l.

Locality: Shore, Atlit, 12.IX.49 (1), incomplete, 22 mm long, atokous.

Platynereis Kinberg, 1865*Platynereis dumerilii* (Audouin and Milne-Edwards), 1833*Platynereis dumerilii*, Fauvel, 1923, pp. 359-360, fig. 141, a-f.

Localities: (a) Shore, Tel Aviv, 20.V.33 (10), 4 complete, 11-20 mm long, 6 incomplete, 11 to 18 mm long; all atokous.

(b) Shore, Jaffa, 24.IV.33 (11), 7 complete, 15 to 25 mm long, 4 incomplete, up to 15 mm long; all atokous.

NEPHTHYDIDAE

Nephtys Cuvier, 1817*Nephtys hystricus* McIntosh, 1900*Nephtys hystricus*, Fauvel, 1923, pp. 373-375, fig. 146, a-e.

Localities: (a) Shore, Atlit, Stn. 4 (1).

(b) Off Kfar Vitkin, Stn. 618 (2).

(c) Off Nabi Yunis, Stn. 625 (1).

(d) Off Nabi Rubin, Stn. 649 (3).

(e) Off Gaza, Stn. 656 (3).

(f) Off Atlit, Stn. 664 (1).

(g) Off Tel Aviv, Stn. 672 (2); Stn. 692 (1).

(h) Off Caesarea, Stn. 804 (1).

The specimen from Stn. 664 is complete and measures 50 mm long; the other specimens are fragmentary and vary between 10 and 15 mm in length.

Aglaophamus Kinberg, 1865*Aglaophamus inermis* (Ehlers), 1887*Nephtys inermis*, Fauvel, 1923, pp. 375-376, fig. 147, a-f.

Locality: Off Caesarea, Stn. 700 (1); Stn. 807 (1); both specimens are incomplete, measuring 15 and 34 mm long.

Although Fauvel (1923) questions whether or not this species has eyes, both specimens reported here possess them and Hartman (1940) also notes their presence.

GLYCERIDAE

Glycera Savigny, 1818*Glycera tessellata* Grube, 1863*Glycera tessellata*, Fauvel, 1923, p. 387, fig. 152, a-c.

- Localities: (a) Shore, Atlit, Stn. 4 (1).
 (b) Off Rafah, Stn. 547 (1).
 (c) Off Nahariya, Stn. 552 (1); Stn. 637 (2).
 (d) Off Gaza, Stn. 630 (1); Stn. 678 (2).
 (e) Off Atlit, Stn. 664 (1); Stn. 694 (1).
 (f) Off Caesarea, Stn. 728 (1); Stn. 804 (1).
 (g) Off Nabi Rubin, Stn. 743 (1); Stn. 798 (2).
 (h) Off Nabi Yunis, Stn. 773 (1).

All these specimens are incomplete and measure between 6 and 35 mm long.

Glycera rouxii Audouin and Milne-Edwards, 1833*Glycera rouxii*, Fauvel, 1923, p. 389, fig. 138, a-d.

- Localities: (a) Off Gaza, Stn. 538 (1).
 (b) Off Caesarea, Stn. 565 (1).
 (c) Off Kfar Vitkin, Stn. 618 (1).
 (d) Off Nabi Yunis, Stn. 627 (2).
 (e) Off Rafah, Stn. 632 (1).
 (f) Off Atlit, Stn. 724 (1).
 (g) Off Natanya, Stn. 776 (1).

One of the specimens from Stn. 627 is complete, 60 mm long, but all the others are anterior fragments measuring between 16 and 35 mm long.

EUNICIDAE

EUNICINAE

Eunice Cuvier, 1817*Eunice torquata* Quatrefages, 1865*Eunice torquata*, Fauvel, 1923, pp. 401-402, fig. 157, 1-o.

- Localities: (a) Off Nahariya, Stn. 636 (1), incomplete, 22 mm long.
 (b) Off Cape Carmel, Stn. 275 (1), incomplete, 45 mm long.

ONUPHINAE

Diopatra Audouin and Milne-Edwards, 1833*Diopatra neapolitana* Delle Chiaje, 1841*Diopatra neapolitana*, Fauvel, 1923, pp. 419-420, fig. 166, a-h.

- Localities: (a) Off Gaza, Stn. 538 (1).
 (b) Off Nabi Rubin, Stn. 648 (1).
 (c) Off Atlit, Stn. 662 (1), with tube.
 (d) Off Caesarea, Stn. 807 (1), with tube.

All these specimens are anterior fragments measuring 8-12 mm long.

Hyalinoecia Malmgren, 1867*Hyalinoecia tabicola* (O. F. Müller), 1776*Hyalinoecia tubicola*, Fauvel, 1923, pp. 421-422, fig. 166, i-q.

- Locality: Off Caesarea, Stn. 805 (1), very small fragment 4 mm long, with a small piece of tube.

LUMBRINERINAE

Lumbrineris Blainville, 1828

Lumbrineris impatiens (Claparède), 1868

Lumbriconereis impatiens, Fauvel, 1923, pp. 429-430, fig. 171, a-i.

Localities: (a) Off Nabi Rubin, Stn. 576 (1), incomplete, 8 mm long.

(b) Off Natanya, Stn. 703 (1), incomplete, 8 mm long.

Drilonereis Claparède, 1870

Drilonereis filum (Claparède), 1868

Drilonereis filum, Fauvel, 1923, p. 436, fig. 174, a-h.

Localities: (a) Off Atlit, Stn. 509 (1).

(b) Off Tel Aviv, Stn. 672 (1).

(c) Off Caesarea, Stn. 728 (1).

All these specimens are incomplete, measuring between 16 and 37 mm long.

ORBINIIDAE

Orbinia Quatrefages, 1865

Orbinia foetida (Claparède), 1868

Orbinia foetida, Fauvel, 1927, pp. 14-16, fig. 4, a-l.

Locality: Shore, Atlit, December, 1934 (2), anterior pieces, each 15 mm in length.

Scoloplos Blainville, 1820

Scoloplos haasi (Monro), 1937

Scolaricia haasi Monro, 1937, pp. 83-86, fig. 1, a-d.

Locality: Shore, between Acre and Jaffa, November 1934 (1), Holotype in B. M. (N. H.) coll., Reg. No. 1937. 4.7.38, incomplete, about 60 mm long.

In the thorax there are 24 chaetigers, with dorsal cirri appearing in the middle region; a single podial papilla is present from the same region in the middle of uropodia. Thoracic notopodial chaetae are crenate capillaries and neuropodia also have these and 2 or 3 rows of hooded hooks. In thoracic neuropodial ridges there are no dividing notches.

Foliateous branchiae appear on the first abdominal chaetiger. Abdominal parapodia have a short dorsal cirrus and a bilobed neuropodial lobe; there is no ventral cirrus. Abdominal chaetae are crenate capillaries with those in neuropodia having apically tapered ends.

In lacking a notch dividing thoracic neuropodia this species is referable to *Scoloplos* and not *Scolaricia*.

SPIONIDAE

Prionospio Malmgren, 1867

The prostomium has no frontal peaks. Branchiae are confined to the anterior region and are normally foliateous or filiform but may be pinnate; simple capillary chaetae and pluridentate hooded hooks are present.

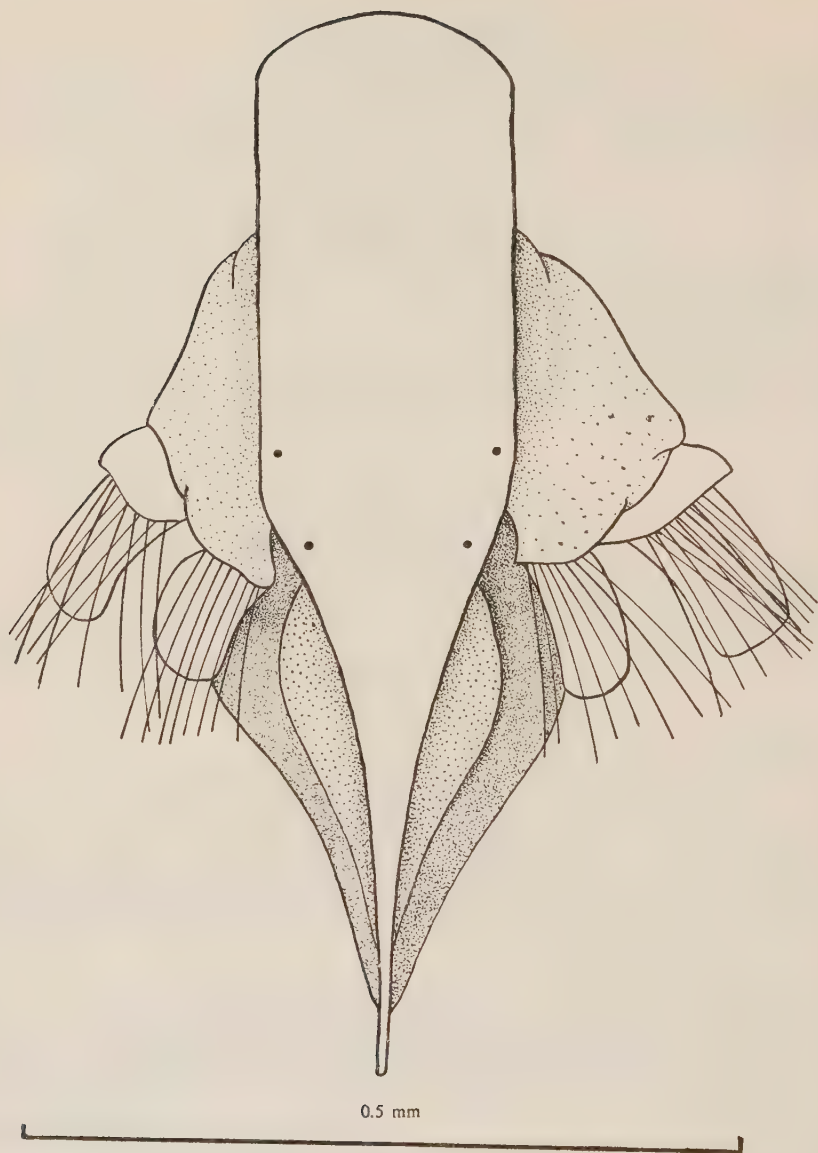


Figure 2

Prionospio ehlersi. Dorsal view of the prostomium and the first pair of chaetigers. (Specimen from Stn. 618)

KEY TO SPECIES HERE REPORTED FROM THE ISRAEL COAST

1. With 4 pairs of branchiae on the 2nd to the 5th chaetigers. 2
 With 11 pairs of foliaceous branchiae on the 2nd to the 12th chaetigers and with 2 pairs of eyes *P. cirrifera*
 2. With 2 pairs of eye-spots; prostomium as in Figure 1; with the 1st pair of branchiae pinnate and the remainder foliaceous or filiform *P. ehlersi*
 Without eye-spots; prostomium as in Figure 2; with the 1st and 4th pair of branchiae pinnate and the others foliaceous *P. steenstrupi*

Prionospio cirrifera Wiren, 1883

Prionospio cirrifera, Fauvel, 1927, pp. 62-63, fig. 21, k-n.

Locality: Off Nabi Rubin, Stn. 649 (1), anterior piece, 6 mm long for about 50 chaetigers.

Prionospio ehlersi Fauvel, 1928

(Figure 2)

Prionospio ehlersi, Fauvel, 1936, pp. 61-62, fig. 4, a-e.

- Localities: (a) Off Caesarea, Stn. 565 (2); Stn. 643 (1); Stn. 700 (5); Stn. 726 (2); Stn. 751 (3); Stn. 807 (2).
 (b) Off Atlit, Stn. 614 (1); Stn. 664 (5); Stn. 665 (4); Stn. 695 (2); Stn. 749 (6).
 (c) Off Kfar Vitkin, Stn. 618 (8).
 (d) Off Gaza, Stn. 630 (1).
 (e) Off Nabi Rubin, Stn. 650 (3).
 (f) Off Tel Aviv, Stn. 672 (1); Stn. 673 (2); Stn. 692 (5); Stn. 738 (3); Stn. 769 (1).
 (g) Off Nabi Yunis, Stn. 674 (4); Stn. 773 (3).
 (h) Off Natanya, Stn. 703 (9).

All specimens are anterior pieces measuring between 5 and 12 mm in length.

Prionospio steenstrupi Malmgren, 1867

(Figure 3)

Prionospio steenstrupi, Fauvel, 1927, p. 60, fig. 21, f-i.

- Localities: (a) Off Nabi Rubin, Stn. 574 (1); Stn. 798 (1).
 (b) Off Kfar Vitkin, Stn. 618 (6).
 (c) Off Rafah, Stn. 634 (2); Stn. 650 (9).
 (d) Off Atlit, Stn. 664 (2); Stn. 665 (1).
 (e) Off Tel Aviv, Stn. 673 (1); Stn. 692 (9); Stn. 779 (1).
 (f) Off Nabi Yunis, Stn. 674 (2).
 (g) Off Natanya, Stn. 703 (1).
 (h) Off Caesarea, Stn. 728 (1).

All specimens are anterior pieces measuring between 5 and 12 mm in length.

It is rare for a complete specimen of either *P. ehlersi* or *P. steenstrupi* to be collected and rare too for the full complement of branchiae to be retained, so that emphasis must be placed on the differences in the prostomium of each of these species. These have been illustrated in Figure 2 and 3. The presence or absence of eyes appears to be of importance but may result in confusion with a third species, *P. malmgreni*.

Claparède, which appears to be identical with *P. steenstrupi* except in having 2 pairs of eye-spots.

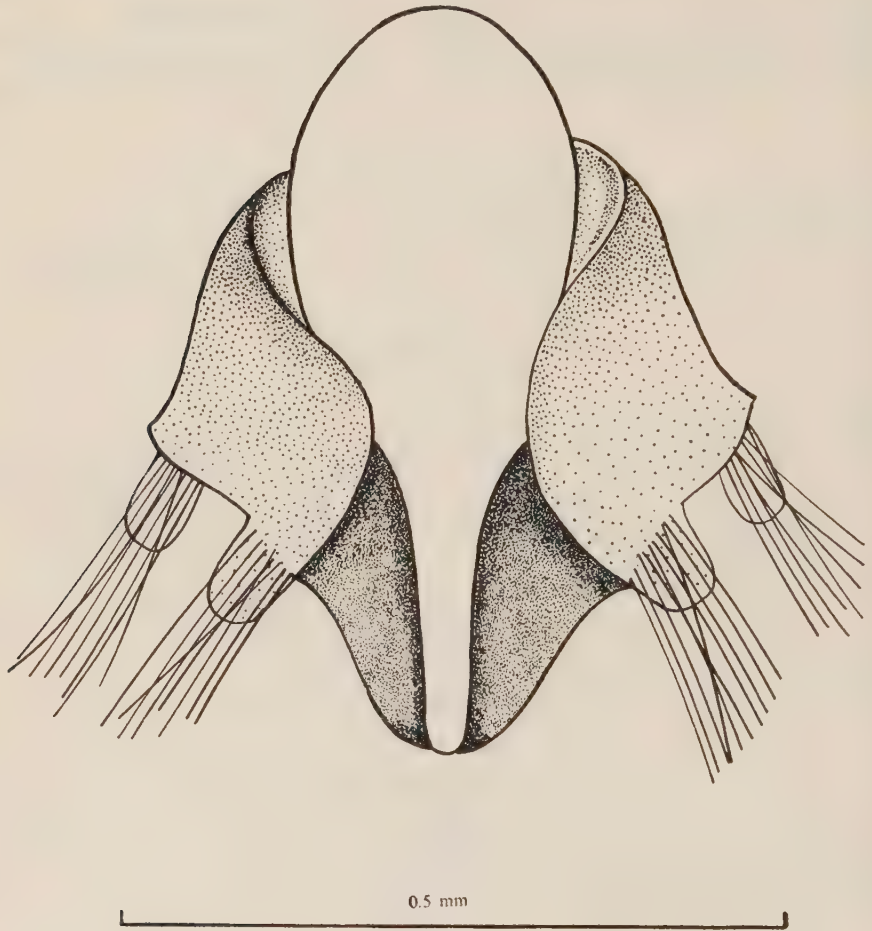


Figure 3

Prionospio steenstrupi. Dorsal view of the prostomium and the first pair of chaetigers. (Specimen from Stn. 650)

MAGELONIDAE

Magelona F. Müller, 1858

Magelona papillicornis F. Müller, 1858

Magelona papillicornis, Fauvel, 1927, pp. 64-65, fig. 22, a-k.

Locality: Off Tel Aviv, Stn. 620 (1), incomplete, without palps, 11 mm long for 9 anterior and 16 posterior chaetigers.

DISOMIDAE

Poecilochaetus Claparède, 1874*Poecilochaetus serpens* Allen, 1904*Poecilochaetus serpens*, Fauvel, 1927, pp. 67-68, fig. 23, a-m.

Localities: (a) Off Nahariya, Stn. 638 (2), incomplete, 8 mm and 23 mm long.

(b) Off Tel Aviv, Stn. 672 (1), incomplete, 8 mm long.

(c) Off Caesarea, Stn. 805 (1), incomplete, 5 mm long.

PARAONIDAE

Aricidea Webster, 1879

Prostomium with a dorsal antenna and with or without eyes. Branchiae begin on the 4th or 5th chaetiger. Notopodial cirri present but neuropodial cirri normally absent except sometimes on anterior feet.

Aricidea assimilis sp. nov.

(Figure 4)

Localities: (a) Off Gaza, Stn. 539 (1), anterior piece, 3 mm long, with the antenna reaching to the 8th chaetiger and 19 pairs of branchiae from the 4th to the 22nd chaetiger.

(b) Off Nahariya, Stn. 638 (2), anterior pieces, 3 mm long, one with the antenna reaching to the 6th chaetiger, the other has lost its antenna; branchiae lost. Stn. 661 (1), anterior piece 6.5 mm long 19 pairs of branchiae from the 4th to the 22nd chaetiger; antenna lost.

(c) Off Atlit, Stn. 664 (1), anterior piece, 15 mm long, antenna lost; 19 pairs of branchiae from the 4th to the 22nd chaetiger. Stn. 665 (4), anterior pieces, 3 to 5 mm long, antenna present on one specimen reaching back to the 8th chaetiger; branchiae mainly lost. Stn. 749 (2), both anterior pieces 6 and 10 mm in length, one with the antenna reaching to the 13th chaetiger, the other has lost its antenna; branchiae mainly lost.

(d) Off Tel Aviv, Stn. 671 (1) anterior piece, 4 mm long with the antenna reaching to the 6th chaetiger and 19 pairs of branchiae from the 4th to the 22nd chaetiger. Stn. 738 (1), anterior piece 5 mm long with the antenna reaching to the 9th chaetiger and branchiae on most feet from the 4th to the 22nd.

(e) Off Caesarea, Stn. 735 (3), anterior pieces 3-7 mm long, with the antenna on one reaching to the 10th chaetiger but lost on the others; branchiae mostly missing.

SPECIFIC
DIAGNOSIS:

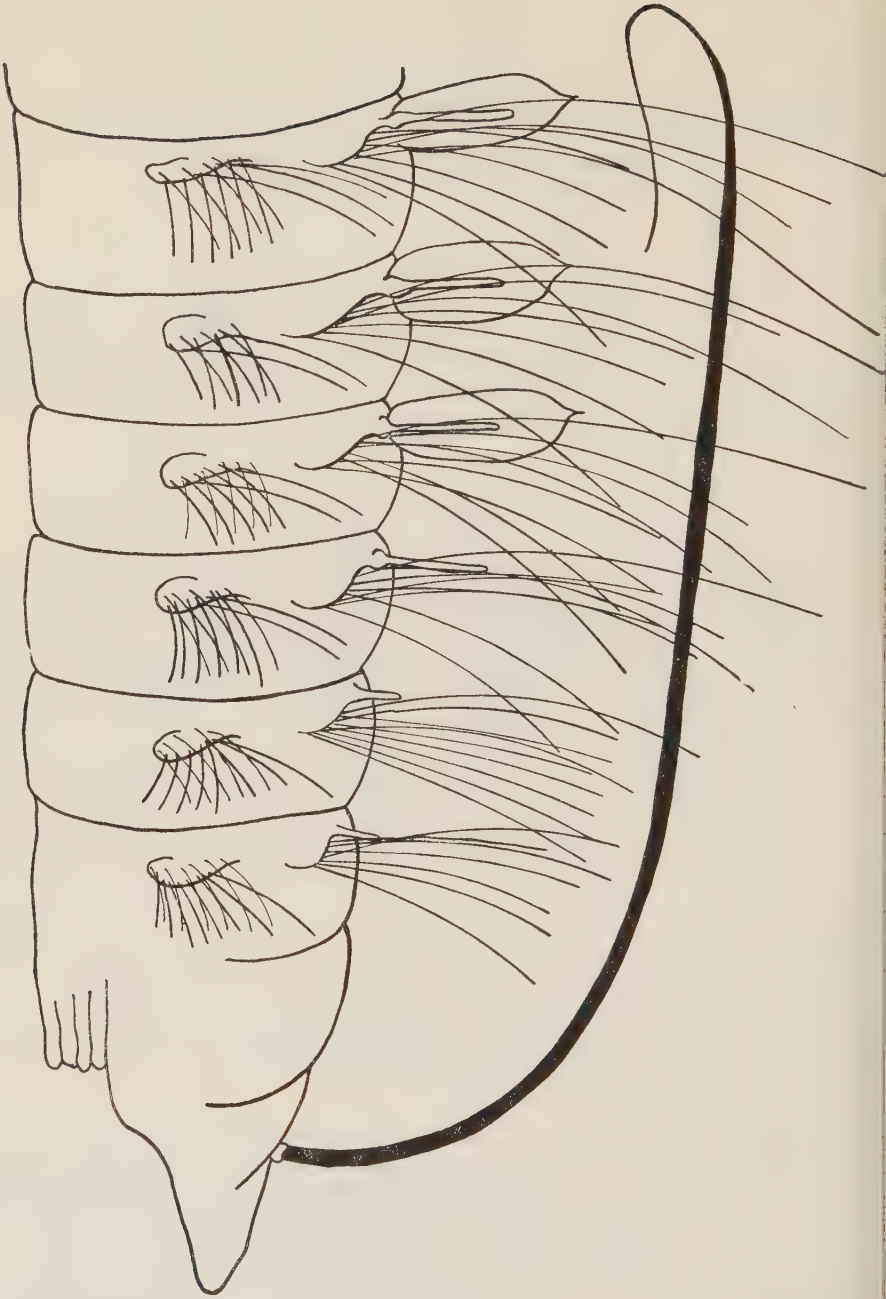
Prostomium bluntly rounded in front without eye-spots and with a long median antenna reaching back from the 6th to the 13th chaetiger. Broadly foliaceous branchiae begin at the 4th chaetiger with one pair present on each chaetiger back to the 22nd. Notopodial cirri present long and slender; neuropodial cirri absent. Notopodia and neuropodia have only simple pointed chaetae.

HOLOTYPE:

B. M. (N. H.) Reg. No. 1955: 10:12:229 from Stn. 539, off Gaza.

PARATYPE:

B. M. (N. H.) Reg. Nos. 1955:10:12:230-237. Stns. 638 (2); 749 (2); 738 (1); 735 (3); and in the Zoology Dept., Hebrew University, Jerusalem, Stns. 561 (1); 664 (1); 665 (4); 671 (1).



0.5 mm

Figure 4

Aricidea assimilis sp. nov. Side view of the anterior end of the holotype

It is unfortunate that no complete specimen of this polychaete has been available for examination, yet the characteristics of the fragments examined indicate that it is distinct from previously described species of *Aricidea*. Thus, although *A. antennata* Annekova, 1934 (from the Chukotosk Sea, off the northern coast of Siberia, the Okhotsk Sea and the Japan Sea) has a long antenna, it also has eye-spots, neuropodia, cirri — lacking in *A. assimilis* — and 18 pairs of gills. *Aricidea jeffreysii* McIntosh, 1879, is known from Naples but has a very short antenna, eye-spots and 12–18 pairs of gills.

FLABELLIGERIDAE

Stylarioides Delle Chiaje, 1841

Stylarioides eruca (Claparède), 1868

Stylarioides eruca, Fauvel, 1927, p. 119, fig. 42, h-l.

Locality: Off Atlit, Stn. 682 (1), complete, 13 mm long.

OPHELIIDAE

Polyophthalmus Quatrefages, 1850

Polyophthalmus pictus (Dujardin), 1839

Polyophthalmus pictus, Fauvel, 1927, pp. 137–138, fig. 48, l-o.

Localities: (a) Shore, Tel Aviv, 20.V.33 (9), complete, all about 9 mm long.

(b) Shore, Tantura, Stn. 10 (1), complete, 4 mm long.

(c) Off Nahariya, Stn. 636 (4), complete, all about 3 mm long.

CAPITELLIDAE

Notomastus Sars, 1850

Notomastus sp.

Localities: (a) Off Natanya, Stn. 568 (1).

(b) Off Nabi Rubin, Stn. 649 (3).

(c) Off Gaza, Stn. 656 (2).

(d) Off Herzliya, Stn. 746 (1).

All these specimens are incomplete and measure between 8–15 mm long for the thorax and a few abdominal segments; they are, therefore, difficult to identify but are probably close to *N. profundus* Eisig (vide Fauvel, 1927, p. 144).

MALDANIDAE

EUCLYMENINAE

Clymene Savigny, 1822

Clymene (*Praxillella*) *gracilis* (Sars), 1861

Clymene (*Praxillella*) *gracilis*, Fauvel, 1927, pp. 178–179, fig. 62, m-p.

Localities: (a) Off Nabi Yunis, Stn. 627 (1).

(b) Off Nabi Rubin, Stn. 649 (1).

(c) Off Tel Aviv, Stn. 692 (1).

(d) Off Atlit, Stn. 724 (1); Stn. 784 (1).

(e) Off Caesarea, Stn. 726 (1); Stn. 735 (1).

All these specimens are very small, incomplete, anterior pieces, measuring between 5 mm long for 7 segments (Stn. 735) and 12 mm long for 11 segments (Stn. 649); there must, therefore, be some doubt about these identifications.

Clymene (Praxillella) lophoseta Orlandi, 1898

Clymene (Praxillella) lophoseta, Fauvel, 1927, p. 181, fig. 62, q-u.

- Localities: (a) Off Nahariya, Stn. 637 (3), 2 head pieces, 1 tail piece and a few intermediate fragments between 4 and 9 mm long.
 (b) Off Gaza, Stn. 656 (2), tail pieces 4 and 8 mm long. 3 intermediate pieces are also present.
 (c) Off Nabi Yunis, Stn. 771 (1), tail piece, in segmental fragments.

Because of the fragmentary nature of this material there must be some doubt about these identifications.

Johnstonia Quatrefages, 1865

Johnstonia clymenoides Quatrefages, 1865

Johnstonia clymenoides, Fauvel, 1927, pp. 184-185, fig. 64, a-h.

- Locality: Shore, Atlit, 25.IV.35 (1), posterior end, 25 mm long.

O W E N I I D A E

Owenia Delle Chiaje, 1841

Owenia fusiformis Delle Chiaje, 1841

Owenia fusiformis, Fauvel, 1927, pp. 203-204, fig. 71, a-f.

- Localities: (a) Off Caesarea, Stn. 686 (1), tube only.
 (b) Off Tel Aviv, Stn. 719 (1), incomplete, 5 mm long.
 (c) Off Atlit, Stn. 724 (7), all incomplete, up to 8 mm long.

S T E R N A S P I D A E

Sternaspis Otto, 1820

Sternaspis scutata (Ranzani), 1817

Sternaspis scutata, Fauvel, 1927, pp. 216-218, fig. 76, a-g.

- Localities: (a) Off Kfar Vitkin, Stn. 519 (1); Stn. 667 (1).
 (b) Off Tel Aviv, Stn. 524 (1); Stn. 673 (1); Stn. 692 (1); Stn. 738 (1); Stn. 800 (1); Stn. 875 (4).
 (c) Off Gaza, Stn. 540-39 (1); Stn. 629 (12); Stn. 656 (1); Stn. 657 (1).
 (d) Off Rafah, Stn. 547 (2); Stn. 633 (12); Stn. 634 (1).
 (e) Off Caesarea, Stn. 565 (1); Stn. 643 (1); Stn. 727 (1); Stn. 805 (2).
 (f) Off Natanya, Stn. 569 (1); Stn. 778 (1); Stn. 792 (2).
 (g) Off Ashkelon, Stn. 581 (2).
 (h) Off Nabi Yunis, Stn. 625 (1); Stn. 787 (1).
 (i) Off Nahariya, Stn. 636 (1).
 (j) Off Herzliya, Stn. 647 (2); Stn. 766 (2).
 (k) Off Nabi Rubin, Stn. 649 (1); Stn. 716 (6); Stn. 717 (5); Stn. 741 (1); Stn. 861 (4).
 (l) Off Atlit, Stn. 733 (1).

All these specimens are complete, measuring between 2.5 mm to 25 mm long.

AMPHARETIDAE

Amphicteis Grube, 1850*Amphicteis gunneri* (Sars), 1830

Amphicteis gunneri, Fauvel, 1927, p. 231, fig. 80, a-k.

- Localities: (a) Off Kfar Vitkin, Stn. 618 (1); Stn. 664 (1).
(b) Off Rafah, Stn. 634 (1).
(c) Off Nahariya, Stn. 661 (1).
(d) Off Tel Aviv, Stn. 672 (1); Stn. 673 (2).
(e) Off Atlit, Stn. 695 (1); Stn. 757 (1); Stn. 783 (1).
(f) Off Caesarea, Stn. 751 (1).

The majority of these specimens are complete and measure up to 20 mm in length.

TEREBELLIDAE

Terebellides Sars, 1835*Terebellides stroemi* Sars, 1835

Terebellides stroemi, Fauvel, 1927, pp. 291-2, fig. 100, i-q.

- Localities: (a) Off Tel Aviv, Stn. 522 (2); Stn. 672 (2); Stn. 692 (10); Stn. 744 (1).
(b) Off Natanya, Stn. 568 (1); Stn. 703 (1).
(c) Off Nabi Rubin, Stn. 573 (4); Stn. 650 (2).
(d) Off Atlit, Stn. 614 (1); Stn. 664 (2); Stn. 757 (1).
(e) Off Nahariya, Stn. 637 (5).
(f) Off Gaza, Stn. 656 (1).
(g) Off Nabi Yunis, Stn. 674 (1); Stn. 771 (1).

The majority of these specimens are complete and measure up to 35 mm in length

SABELLIDAE

Dasychone Sars, 1862*Dasychone cingulata* Grube, 1871

Dasychone cingulata, Fauvel, 1932, p. 236.

Dasychone cingulata, Monro, 1937, p. 86.

- Localities: (a) Shore, Atlit, 12.IV.35 (3), incomplete, 35 mm long; Stn. 3 (1), complete, 35 mm long.
(b) Shore, Tel Aviv, 12.IX.35 (5), complete, about 35 mm long.

SERPULIDAE

Serpula Linnaeus, 1758*Serpula vermicularis* Linnaeus, 1758

Serpula vermicularis, Fauvel, 1927, pp. 351-2, fig. 120, a-q.

- Locality: Off Atlit, Stn. 509 (1), complete, 10.5 mm long with extended operculum.

Hydroides Gunnerus, 1768*Hydroides norvegica* Gunnerus, 1768

Hydroides norvegica, Fauvel, 1927, pp. 356-357, fig. 122, i-o.

- Locality: Off Atlit, Stn. 507, a few broken specimens and tubes. Two pieces, which may together form one specimen, measure 11 mm long with extended proboscis.

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AN EXTENDED VENOM GLAND IN THE ISRAEL MOLE VIPER,
ATRACTASPIS ENGADDENSIS HAAS 1950

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Several species of venomous snakes are known to have venom glands which extend far back along the trunk. In *Doliophis* (= *Maticora*) *intestinalis*, an Asian Elapid, the length of the gland attains one-quarter of the total length of the body. In a specimen 99 cm long, the gland reached 35 cm (Phisalix 1922). A specimen of *Doliophis* (= *Maticora*) *bivirgatus* of total length of 121 cm investigated by Radovanovic (1935) had on the left a gland of 26 and on the right a gland of 23 cm length.

The only Viperid in which a similarly extended gland has hitherto been described is the African genus, *Causus*. Four species of this genus were investigated (Haas 1931, 1938, 1952). In *C. lichtensteinii* and *C. defilippii* a gland of normal size and position was found, whereas *C. resimus* and *C. rhombeatus* have a posteriorly extended venom gland. In *C. rhombeatus* the gland is 7–10 cm long (Phisalix 1922, Radovanovic 1935).

Of the genus *Atractaspis*, two species (*aterrima* and *corpulentus*) were investigated by Haas (1938, 1952), who found them to have a normal venom gland, ending at the mandibular joint. There are, however, many differences in the head musculature between these two species and other vipers.

During work on the head muscles of Viperidae, a specimen of *Atractaspis engaddensis* Haas 1950 was also dissected (specimen from Ein Geddi, R. 1206, Collection of the Tel Aviv University) and was found to have an extended venom gland which reached beyond the neck, far behind the quadrato-mandibular articulation. This snake was 59 cm long and had on the left a venom gland of about 4.5 cm and on the right a gland of 4 cm (including the duct), reaching to the 30th and 23rd ventral scale respectively.

The duct of the venom gland extends until the mandibular joint, as from there the gland itself is represented by an elongated cylindrical structure. After the removal of the skin, this gland, seen from the side, appears as a narrow white strip, running along the middle of the compressor muscle (Figures 1, 2, 3). The entire gland can be exposed only after the dissection of this muscle.

The compressor of the gland originates dorsally from the head of the quadratum and from the enormous Harder's gland. Progressing posteriorly, more and more

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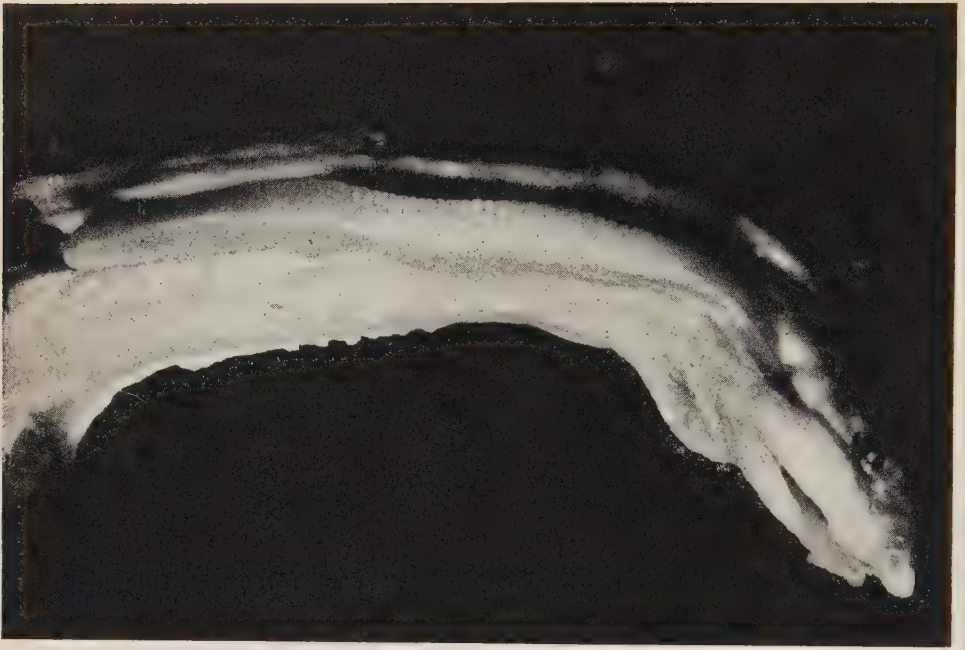


Figure 1

Venom gland of *A. engaddensis* Haas after removal of the skin (for explanation see Figure 2)

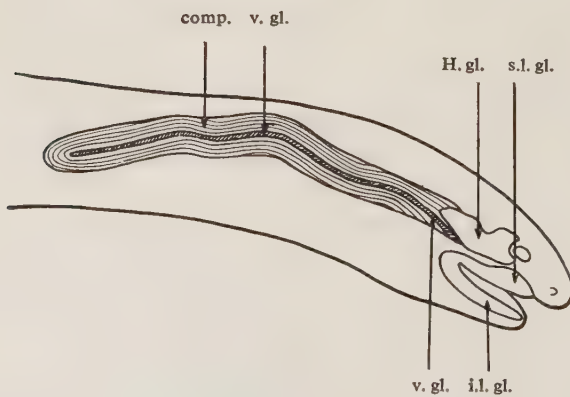


Figure 2

Diagram of venom gland in Figure 1.

Abbreviations: *comp.*: compressor of the gland; *H. gl.*: Harder's gland; *i. l. gl.*: infralabial gland; *s. l. gl.*: supralabial gland; *v. gl.*: venom gland.

fibres originating from the venom gland capsule proper are added to the muscle. At the posterior end, the fibres encircle the tip of the gland, turning ventrally and anteriorly. Proceeding in this direction, the fibres insert on the ventral face of the gland capsule, medially as well as laterally. The anteriormost fibres of the compressor insert at the angle of the mouth and at the lower jaw.

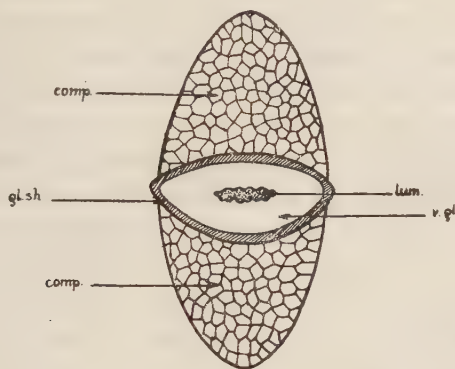


Figure 3

Transverse section through the venom gland and compressor muscle

Abbreviations: *comp.*: compressor muscle of the gland; *lum.*: lumen of the gland; *gl. sh.*: capsule of the gland; *v. gl.*: secretory part of the venom gland

The gland and its enveloping muscle lie free and uncovered (except by the skin) in a shallow depression of the lateral body muscles.

It may be of interest to mention that the gland and compressor muscle on the left side, beside being longer, was twisted around its long axis, so as to cause the dorsal face to become ventral and vice versa. In three more specimens investigated elongated venom glands were found, longer on the left than on the right side, but the same unilateral, twisted condition was present in one of them only (R. 1169, Coll. of the Tel Aviv University; spec. from Ein Geddi); the second (from near Jebel Ureif, R. 1565, same collection) had at the same point merely a constriction of the compressor. A third specimen (from Ein Geddi) had twisted venom glands on both sides.

The gland compressor muscle of *Atractaspis engaddensis* is doubtless identical with the peculiar gland muscle of *Atractaspis corpulentus* and *A. aterrima* described by Haas (1931, 1952) and may be homologous to the gland compressor of *Causus resimus* and *C. rhombeatus* (Radovanovic 1935; Haas 1931, 1935).

The gland muscle in *Atractaspis corpulentus* and *A. aterrima* is divided into two distinct parts: the anterior part originates from Harder's gland, the posterior begins from the head of the quadratum and inserts on the mandible (Haas 1931, 1952). The innervation of these two parts was found by the present author to be similar to the innervation of the *M. adductor externus superficialis, part 1b* and *M. adductor*

*externus profundus** of other Solenoglypha, as well as to the innervation of the gland compressor of *Atractaspis engaddensis*.

The same conditions were also found in specimens of *Atractaspis irregularis* and *A. heterochilus* which were investigated.

These findings seem to show that the anterior part of the gland compressor of *A. corpulentus*, *A. aterrima*, *A. irregularis* and *A. heterochilus* is homologous to the *M. adductor externus superficialis, part 1b* and the posterior to the *M. adductor externus profundus* of other Solenoglypha. This opinion would be in disagreement with Haas' interpretation, which regards the whole muscle of these snakes as being homologous to the *Adductor superficialis, part 1b* of other Solenoglypha.

In *Atractaspis engaddensis* the gland compressor has evolved in a much more elaborate form and the two parts of the muscle can no more be distinguished; however, its origin and insertion points, as well as its innervation, show it to be a homologue compound of *part 1b* and *profundus* together, hence of the same origin as the gland muscle of the *Causus* species. The innervation of this muscle in *A. engaddensis* corresponds to the innervation of *part 1b* and *profundus* muscles in *Vipera palaestinae* (Kochva, 1958), a viper with a "normal" venom apparatus. The nerve to the compressor comes from the posterior face of the *R. mandibularis nervi trigemini*.

There are more peculiarities in the head musculature of this snake, possibly connected with its fossorial habits and with the long poison fang and its erection. The *M. protractor quadrati* and the *M. protractor pterygoidei* have moved to the ventral side of the skull (as in *A. corpulentus*, Haas 1931), making it possible to erect the fang and strike with an almost closed mouth.

The author owes a debt of gratitude to Dr. D. C. FitzSimons, to Dr. S. Bruniquel, to Dr. M. Dor, to Dr. L. Cahen and to Dr. M. Poll for the supply of some of the specimens of *Atractaspis* investigated and to Prof. G. Haas, Dr. H. Mendelssohn and Mr. H. J. Hoofien for valuable suggestions and general assistance in the preparation of the present paper.

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* Lakjer's (1926) nomenclature is used as amended by Haas (1952) and as used in my paper on *Vipera palaestinae* (Kochva, 1958).

NOTES ON TWO SPECIES OF HETEROPTERA FROM ISRAEL

E. WAGNER

Hamburg

1. *The female of Stictopleurus parvus* Lindberg (1948) (Coreidae)

C o l o u r light ochre-yellow and thickly covered with fine short whitish hairs. The punctured grooves of the dorsal side generally colourless, brownish on the posterior corners of the pronotum only. Pilosity of the ventral side whitish and somewhat longer than that on the dorsal side.

H e a d large, slightly broader than long. The vertex 2.3–2.5 times as broad as the large round eye; punctured grooves on the frons and vertex often brownish. Antennae light ochre-yellow. The first joint short and stout and often black-spotted; 2nd joint more than twice the length of the first and 1.1–1.2 times as long as the third; fourth joint longest, spindle-shaped and often brownish, about 1.2 times as long as the second.

P r o n o t u m trapezoidal; the sides in front of the anterior corners slightly concave. Distinct transverse furrows present, their anterior margin pronouncedly thickened and rugose, lateral callosities also surrounded by a rim; posterior margin of the grooves only infrequently somewhat roughened and then only in the centre; median keel distinct, at least in the anterior portion. Scutellum longer than broad, its tip (Figure 14) comparatively narrow but blunt, and provided with a rugose margin.

Hemelytrae hyaline, venation yellow, or often reddish in the posterior part; membrane hyaline.

Back of the abdomen light, the last three segments with black median stripe and, except the last one, often also with black lateral spots, The first segments have a broad light median stripe and are laterally dark.

Ventral surface light, the pilosity on each side forming a longitudinal silvery stripe. Rostrum yellow, its tip black, extending as far as the end of the hind coxae or somewhat beyond. Legs light-coloured, femur strong, with longitudinal rows of fine brown dots, tips of the tibia and tarsal-joints often brownish.

Genital aperture of female (Figure 2) only slightly longer than its width above. First gonapophyses large and protruding, first valvulae large, tips almost pointed and touching each other above the gonapophyses. Second gonapophyses short, second valvulae large. Length of female 6.3–7.1 mm.

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The female of *S. parvus* Ldbg. agrees completely with the male in form and colouration, but is somewhat larger and generally broader; the tip of the scutellum is generally somewhat broader.

The form is closely related to *S. riveti* Royer, and Tamanini (1951) in his work on the *Stictopleurus* of Italy expresses the suspicion that the two may be identical. In *S. riveti*, however, the genital aperture of the female (Figure 3) is even broader and shorter than in *S. parvus*, the first valvulae are shorter and more strongly rounded, and the second valvulae are smaller. The male genital segment in *S. parvus* is smaller (Figure 6) than in *S. riveti* (Figure 7), the pointed median process on the posterior border of the genital aperture is longer and sharper in *parvus*. The parameres in *S. parvus*, viewed from behind (Figure 6), display two distinct tubercles, are strongly curved, and acutely pointed. In *S. riveti* (Figure 7) these tubercles are only very poorly developed and the parameres are stouter and only slightly bent. In lateral view the upper tubercle in *S. parvus* (Figure 10) is always distinct and stands out prominently; in *S. riveti* (Figure 11) it is indistinct and even often lacking. The tip of the scutellum in *S. riveti* is similar (Figure 15) to that of *parvus*, but is nevertheless more acutely pointed.

S. pictus Fieb. is readily distinguishable from both of the above species. The scutellum (Figure 13) is broadly rounded distally, the genital aperture of the female (Figure 1) is much higher than broad, the genital segment of the male (Figure 5) is larger. The parameres (Figure 9) and their hypophyses are robust; in lateral view they display a distinct tubercle on the inside and are strongly curved.

S. abutilon Rossi is much bigger, the scutellum (Figure 16) also broadly rounded distally, the genital aperture of the female (Figure 4) much higher than broad, the genital segment of the male (Figure 8) very large and broad, the parameres (Figure 12) robust, the hypophysis broad, forming an obtuse angle with the body of the paramere; all parts of the paramere, however, lie in a single plane, so that, observed from behind, the paramere (Figure 8) appears nearly straight.

It must be concluded that *S. parvus* Ldbg. and *S. riveti* Royer are very closely related, but I consider it correct not to synonymise them, as there are sufficient differences between them. The grouping of *S. abutilon* Rossi and *S. pictus* Fieb. into a single species as done by Tamanini (1951) seems to me unjustified in view of the differences in the structure of their parameres and their sizes. This point of view gains still further support from the fact that it is always possible to find the two forms apart from each other, although they have been found by us to occur together locally in Southern France.

M. ribauti Vid. has a still broader genital aperture in the female and differently shaped parameres in the male.

I have examined 16 males and 12 females from Israel: Avdat 8.IX.53, 11 males, 12 females; Timna 21.IX.57, 4 males; Jerusalem 12.X.57, 1 male. All submitted J. Wahrman.

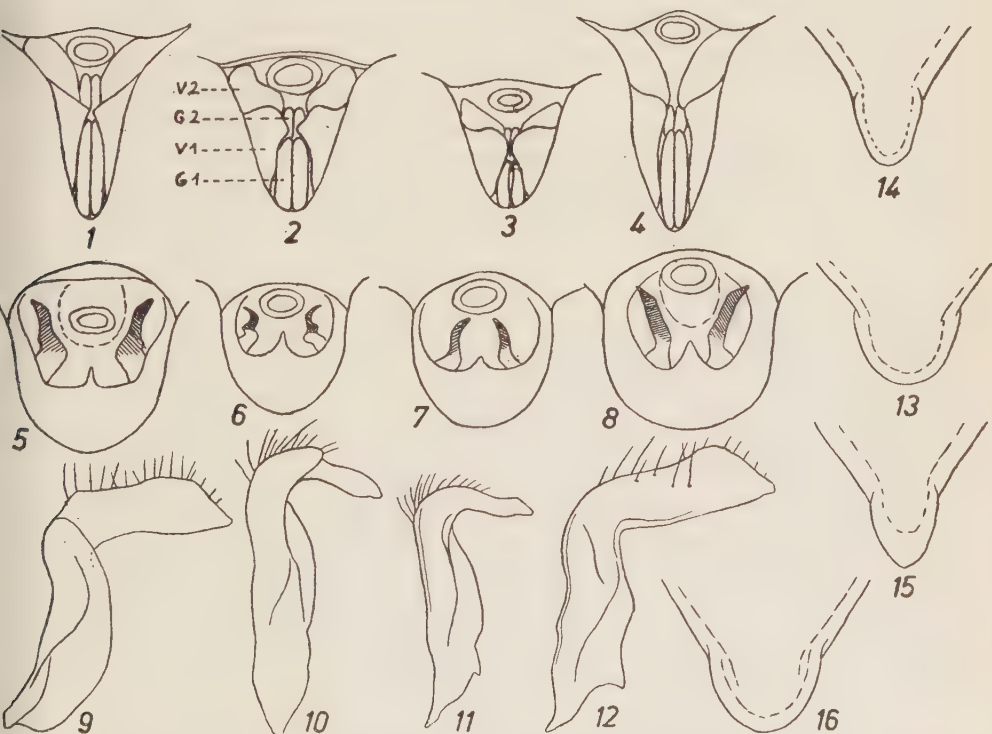
2. The female of *Orthotylus haloxyloni* E. Wagner, 1956 (Miridae)

Description: Body large, elongate elliptic, 3.3 times as long as the pronotum is broad behind. Colour light green, edges of the hemielytrae bright green. Pubescence consists of a dense white tomentum and oblique darker hairs.

Head short. The vertex is distinctly bordered, 2.45–2.5 times as broad as the black-brown eye. Antennae light, with fine light tomentum. First antennal joint thicker than the others, bearing 2–3 light bristles, 1.4 times as long as the breadth of the eye. Second joint slender and rod-shaped, 1.25 times as long as the width of the head and 0.9 times as long as the breadth of the pronotum. Joint III 0.6 times as long as the second. (Fourth joint absent.)

Pronotum short, trapezoidal, posteriorly strongly enlarged. Wing membrane light transparent, smoky-grey, veins yellowish. Rostrum extending to the middle coxae. Legs light greenish-yellow, with fine light pilosity; tibiae with delicate fair spines; tarsi light. Posterior tibia more than four times as long as the tarsus.

Female: 3.55–4.0 mm.



Figures 1–16: *Stictopleurus*. 1–4: genital aperture of the female, hind view, 25 ×; 5–8: genital segment of the male, from behind, 25 ×; 9–12: left paramere, side view, 67 ×; 13–16: tip of scutellum, top view, 25 ×. 1, 5, 9, 13: *S. pictus* Fieb.; 2, 6, 10, 14: *S. parvus* Lindberg;

3, 7, 11, 15: *S. riveti* Royer; 4, 8, 12, 16: *S. abutilon* Rossi

When I originally described this species (1956) only two males were known to me. That the females here described belong to the same species is proved by the fact that they were taken together with two males which completely agree with the type of *O. haloxyloni*; furthermore, no other *Orthotylus* species were found at the same locality.

I have examined two males and four females from Israel: Eilat-Tebkha, 15.I.57, submitted by H. Ginsburg.

The specimens are in my collection and in the collection of the Hebrew University of Jerusalem.

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WHAT IS *CYLINDROSTETHUS BERGROTHI* LINDBERG 1922
(HEM. HET. GERRIDAE)?

E. WAGNER
Hamburg

Cylindrostethus bergrothi Lindberg 1922 was described by Lindberg from a single specimen (♂) caught by U. Salaas in the Jordan Valley on March 14, 1904. A few additional specimens were later captured by the same collector near Jericho. No further specimens of the species have been found since. I have hitherto known of the form only through the description of Lindberg. Now Mr. G. Seidenstücker, Eichstätt, has sent me a specimen (♂) which he received from Mr. R. Linnavuori, Åbo, and which unquestionably belongs to the species described by Lindberg. It originated from the second locality mentioned above and corresponds in all particulars to the description given by Lindberg. The examination of the animal brought to light a number of quite interesting facts.

Mr. Seidenstücker had already examined the gray, feltlike layer covering the surface of the animal and established the fact that it was readily removable by water. It was composed of salt crystals covering the body of the animal. Their regularity and gray colouration, which may well have been a reflection of the presence of impurities, created the impression of a toment.

When the salt crust was removed, the animal proved to be identical to the eastern form of *Gerris paludum* F. not uncommon in Palestine, Syria and Turkey. This form has been described by the author (1954) under the name *Gerris paludum palmonii* E. Wagner. Now that the form has proved to be identical with *Cylindrostethus bergrothi* Lindberg, it will be necessary to alter the name to *Gerris paludum bergrothi* Lindberg.

It is difficult to see what may have impelled Lindberg to classify his new species in the genus *Cylindrostethus* Fieb. Perhaps it was the length of the rostrum, often incorrectly required by older authors (for example Mayr) to extend in *Gerris* as far as the middle of the mesosternum; perhaps it was the misinterpretation of the nature of the salt crust. The genus *Cylindrostethus* Fieb. is neotropical, and in addition has representatives in Ceylon, Celebes and the Philippines. I hesitate to judge its validity as a genus. At any rate the form in question can only be classified in *Gerris* Latr.

The opinion that I have expressed earlier (1954) that we have to do here with an Eastern Mediterranean race of the common *Gerris paludum* F. receives further

support from a number of additional finds that have meanwhile become available to me. The form is closely allied to *G. paludum*, and the differences between the two are rather slight. These have already been mentioned by the author (1954). The East Mediterranean race is smaller and slenderer and the pronotum displays a more or less extended reddish-brown mark divided into two halves by a longitudinal black line; only very rarely is this mark absent. The head is broader in comparison with the pronotum and the eyes consequently project further to the outside over the corners of the pronotum. The thornlike points of the seventh abdominal segment are slenderer and more strongly recurved, but are sometimes directed posteriorly and sometimes medially. The male described by Lindberg (1922), for example, has medially-directed projections. This type of curvature was also encountered in other specimens, but this is not the rule. Slight differences are also to be seen in the structure of the male genitalia. The segments of the typical form are broader and the parameres shorter.

The brown mark on the pronotum may mean that *G. bergrothi* Lindbg. is an independent species, for such colouration of the pronotum is widely employed in the differentiation of the species in the genus *Gerris*. Thus *Gerris costai* H. S. and *G. gibbifer* Schumm. are also differentiated on the basis of this feature and in their case too only slight additional variations are to be found.

A decision on this question is difficult and will only become possible when finds from the area in which both types occur together are made available.

G. paludum bergrothi Lindbg. specimens have recently reached me from the following places and collectors:

Israel: Yarmuk—J. Wahrman, Beisan—Fischer, Sea of Galilee—J. Palmoni.

Syria: Damascus—G. Seidenstücker.

Turkey: Marrasch Adana—G. Seidenstücker.

I am greatly indebted to Mr. G. Seidenstücker, Eichstätt, and Dr. J. Wahrman, Jerusalem, for their highly valued assistance in this work.

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LETTER TO THE EDITOR

On the mating habits of two species of Scorpions, *Leiurus quinquestriatus* H. et E. and *Buthotus judaicus* E. S., A. SHULOV AND P. AMITAI, Department of Zoology, The Hebrew University of Jerusalem.

To the best of our knowledge, no description of the mating habits in scorpions has yet been published.

The following observations on the mating of scorpions have been made by us simultaneously on two species.

On 24.IV.1956 and 2.V.1956 we observed the beginning of the mating in two species of scorpions, *Leiurus quinquestriatus* H. et E. and *Buthotus judaicus* E. S. In both cases the male seized the pedipalps of the female with his own and started pulling the female towards him, paused and then pushed her back, repeating this procedure again and again. This action resulted in close contact of the chelicerae of both partners and of the front margins of their carapaces. The body of the male trembled, the trembling being transmitted to the female through the pedipalps. During these movements the first pair of legs of the male drummed upon his own chelicerae and the chelicerae, legs and carapace of the female, but did not reach the pectines. The pectines of the male were also active, their dents moving independently. Suddenly the male raised his prosoma at an angle of some 45°, his tail pressing against the soil, and from the genital pore appeared the spermatophore in the form of a minute dark rod-like object. The ejection of the spermatophore continued for some 5-8 seconds, during which it was directed almost horizontally towards the female. When completely expelled the spermatophore fell to the ground and remained connected to the body of the male by the flagellum. He violently pushed the female towards the spermatophore. It is possible that at this moment, the introduction of the spermatophore took place, but it was not clearly seen. Then the scorpions separated and started running in the jar. A study of the spermatophore revealed that it is formed of two halves (prospermatophores) expelled from the paraxial organs of the male. These two prospermatophores consist chiefly of elongated half-tubes which meet together along their margins and form a complete tube. This tube bears four pairs of lobes on its distal end, from which the flagellum also originates. The proximal end of the tube is continued in a curved "anchor piece" (Figure 1).

Although no introduction of the spermatophore has exactly been seen so far, the nuptial habits observed seem to suggest the following:

It appears that the mating process of these scorpions is similar to that described by Kew¹ for the Pseudoscorpions where the male places his spermatophore on the ground and pulls the female



Figure 1

The spermatophore of *Leiurus quinquestriatus*, standing upright on the stone (nearly natural size)



Figure 2

The spermatophore enlarged. The curved flagellum is seen on the upper end together with chitinous lobes. The spermatophore is fastened to the stone by the curved "anchor" piece. The white objects are particles of sand adhering to the spermatophore

against it. The spermatophore is formed from the paraxial organ during 5–8 seconds, just before the mating. It is placed on the ground and adheres there while the male controls the direction of the spermatophore by the flagellum and pulls the female towards it. The female collects the spermatophore into the vagina directly from the ground and a part of the spermatophore containing sperm remains in her genital opening.

The pectines apparently play no direct part in the sexual intercourse.

A full account of the observations together with a detailed morphological study will be published elsewhere.

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Nine new fish from the Mediterranean coast of Israel. M. DOR, *Ehud Hakvutzot ve'Hakibutzim Teachers Seminary*.

Up to now nearly 240 species of fish are known to live near the Mediterranean coast of Israel and are found in various collections.

The following are 9 additional species not yet mentioned for this area. Most of them were found on the market, among the lots of edible fishes. Of these species, those marked are intruders from the Red Sea.

Muraena unicolor Delsnoche.

* *Parexocoetus brachypterus* Richardson.

Coryphaena equiselis L.

Centrolophus crassus C. V.

* *Siganus rostratus* Erhb.

* *Bothus panterinus* Rueppell.

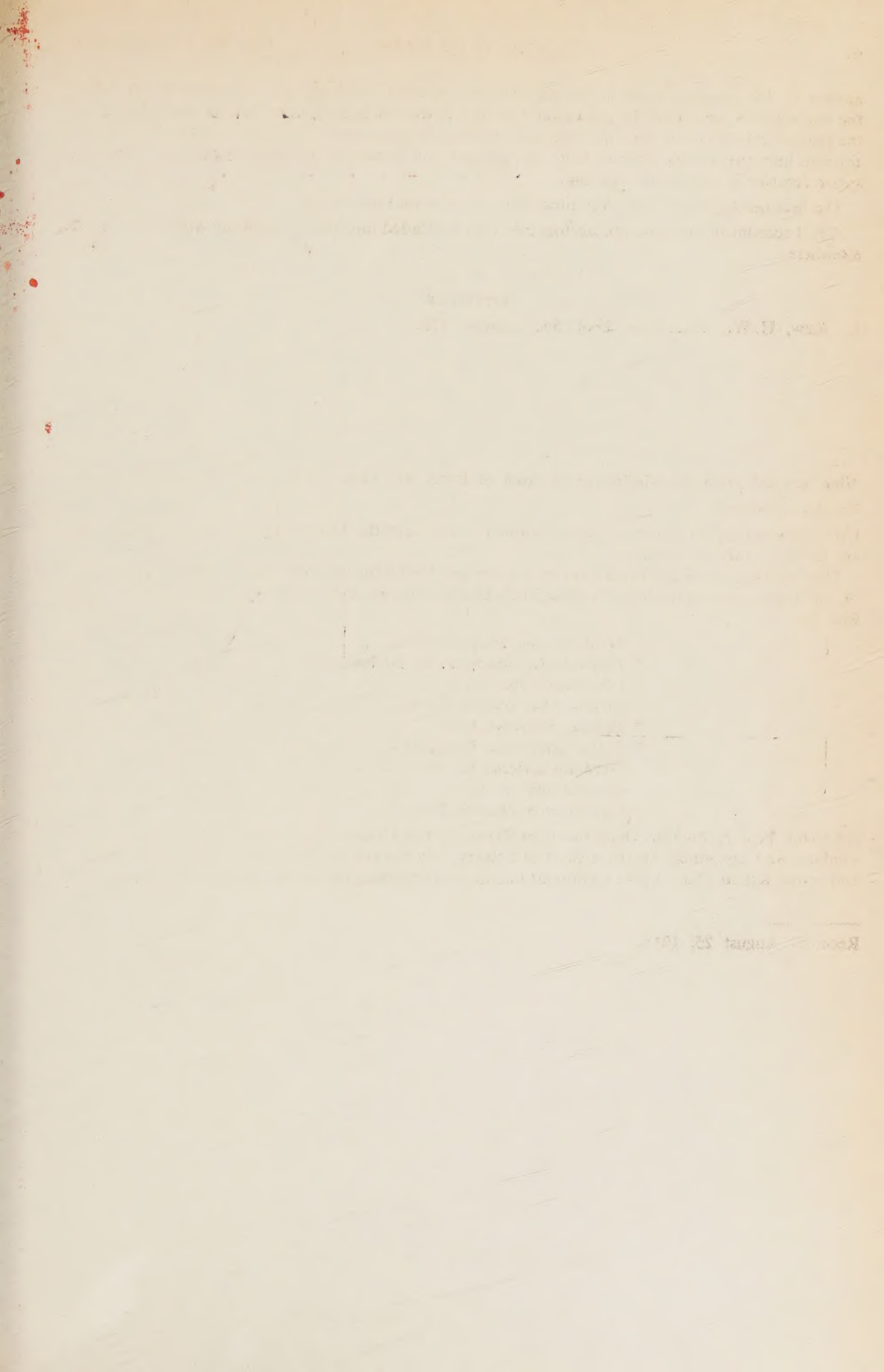
Trachinus araneus C. V.

Carapus imberbis L.

Lepadogaster candolii Risso.

I thank Prof. H. Steinitz, Department of Zoology, The Hebrew University of Jerusalem, for his kindness and assistance. To the School of Fishery, Michmoret, to the Seminary of the Kibbutzim, and to the Kibbutz Saar I give additional thanks for permitting me to use their collections.

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